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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/755,071	01/08/2001	Kie Y. Ahn	M4065.0415/P415	5118

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DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP
2101 L STREET NW
WASHINGTON, DC 20037-1526

EXAMINER

ECKERT II, GEORGE C

ART UNIT PAPER NUMBER

2815

DATE MAILED: 12/31/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/755,071

Applicant(s)
Ahn et al.

Examiner
George C. Eckert II

Art Unit
2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Aug 26, 2002
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28, 30, 31, 33-37, and 39-41 is/are pending in the application.
- 4a) Of the above, claim(s) 1-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-28, 30, 31, 33-37, and 39-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other:

Art Unit: 2815

DETAILED ACTION

Response to Amendment

1. Applicant's amendment dated August 26, 2002 in which claims 19, 31 and 40 were amended and claims 32 canceled has been entered of record.

Election/Restriction

2. Claims 1-18 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 5.

Claim Rejections - 35 U.S.C. § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless -

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371© of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Art Unit: 2815

3. Claims 19, 21, 22, 24, 25, 28, 30, 40 and 41 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6,362,528 to Anand. With regard to claims 19 and 40, Anand teaches, with reference to figures 8-19, a dual damascene structure comprising:

- a semiconductor substrate 11;
- a first insulating layer 25 provided over the substrate;
- a metal layer 17b provided within the first insulating layer;
- at least another or second insulating layer 18 provided over the metal layer;
- a via 19a situated within the second insulating layer 18 and extending to at least a portion of the metal layer, the via being lined with a titanium-silicon-nitride layer 20a and filled with a copper material 20b (col. 13, lines 11-13 and lines 17-18);
- a third insulating layer 27 located over the second insulating layer;
- a trench 19b situated within the third insulating layer and extending to the via, the trench being lined with the titanium-silicon-nitride and filled with copper (col. 13, lines 11-13, 17-18).

Regarding the limitation that the titanium-silicon-nitride layer which lines the via is formed by an organo-metallic-atomic deposited process, such limitation does not further define the structure as instantly claimed, nor serve to distinguish over Anand. Note that a “product by process” claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck, 177 USPQ 523; In re Fessmann, 180 USPQ 324; In re Avery, 186 USPQ 161; In re Wertheim, 191 USPQ 90 (209 USPQ 554 does not deal with this issue); In re Marosi et al, 218 USPQ 289; and particularly In re

Art Unit: 2815

Thorpe, 227 USPQ 964, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process” claim, and not the patentability of the process, and that an old or obvious product produced by a new method is not patentable as a product, whether claimed in “product by process” claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw make clear.

With regard to claims 21 and 22, Anand teaches that the another or second insulating layer 18 is formed of silicon dioxide and is 1 μm or 10,000 Å thick (col. 12, lines 35-37). With regard to claims 24 and 25, Anand teaches that the third insulating layer 27 is formed of silicon dioxide and is 6,000 Å thick (col. 11, lines 41-42, lines 48-50, see also col. 11, lines 52-54). With regard to claim 28, Anand teaches that the copper material is copper (col. 13, lines 17-18). With regard to claim 30, Anand teaches that the substrate is silicon (col. 11, line 32). With regard to claim 40, Anand teaches that the integrated circuit which includes the dual damascene structure is formed as part of a ULSI (ultra large scale integrated circuit) which is considered a processor. Anand also teaches that the integrated circuit having the damascene layers is formed on the same chip as the processor (see generally figures 21-24).

Claim Rejections - 35 U.S.C. § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are

Art Unit: 2815

such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 20, 23, 31, 33, 34, 37 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of US 6,093,966 to Venkatraman et al. (of record). Anand teaches the device of claim 19 as discussed above, which also read on limitations of claim 31, but does not teach that the insulating layers may be formed of polyimide. Venkatraman et al. teach that an insulating layer may be formed of silicon dioxide or polyimide (col. 4, lines 39-54).

Anand and Venkatraman et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to use polyimide as the insulator of Anand. The motivation for doing so is that such a material has a low dielectric constant such that parasitic capacitance between conductors is reduced. Therefore, it would have been obvious to combine Anand with Venkatraman et al. to obtain the invention of claims 20, 23, 31, 33, 34, 37 and 39.

5. Claims 26 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand as applied to claims 19 and 31 above, and further in view of *Ti-Si-N Diffusion Barriers Between Silicon and Copper* to J. S. Reid et al. Anand taught the device of claims 19 and 31 but did not teach that the Ti-Si-N liner layer is between 50 - 200 Å or specifically 100 Å thick. Reid et al. teach, on page 299 in the right hand column, first full paragraph, that a layer of Ti-Si-N may be formed at a thickness of 10 nm (100 Å).

Art Unit: 2815

Anand and Reid et al. are combinable because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the Ti-Si-N layer to a thickness of 100 Å. The motivation for doing so, as is taught by Reid et al., is that such thickness is sufficient to prevent copper migration up to a temperature of 650°C. Therefore, it would have been obvious to combine Reid et al. with Anand to obtain the invention of claims 26 and 27.

6. Claims 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anand in view of Venkatraman et al. and Reid et al. Anand and Venkatraman et al. made obvious the device of claim 31 as discussed above. However, they did not teach that the Ti-Si-N liner layer is between 50 - 200 Å or specifically 100 Å thick. Reid et al. teach that a layer of Ti-Si-N may be formed at a thickness of 10 nm (100 Å).

Anand and Venkatraman et al. are combinable with Reid et al. because they are from the same field of endeavor. At the time of the invention it would have been obvious to a person of ordinary skill in the art to form the Ti-Si-N layer to a thickness of 100 Å. The motivation for doing so, as is taught by Reid et al., is that such thickness is sufficient to prevent copper migration up to a temperature of 650°C. Therefore, it would have been obvious to combine Reid et al. with Anand and Venkatraman et al. to obtain the invention of claims 35 and 36.

Art Unit: 2815

Response to Arguments

7. Applicant's arguments filed August 26, 2002 have been fully considered but they are not persuasive. Regarding claims 19 and 40, Applicant argues that Anand is silent as to forming a "dual damascene structure" comprising *inter alia* "a via situated within said second insulating layer and . . . lined with an *organo-metallic-atomic deposited titanium-silicon-nitride layer* and filled with a copper material." (*Emphasis* in original). However, as made clear in the above rejection, Anand does teach all the structural limitations of instant claims 19 and 40, including a via 19a situated within said second insulating layer 18 and lined with titanium-silicon-nitride layer 20a and filled with a copper material 20b. All the claimed structural limitations have been addressed. As to the new limitation regarding the process of organo-metallic-atomic deposition, as recognized by applicant, this is a processing limitation. As such, it does not distinguish over Anand because the final structures - that instantly claimed and that taught by Anand - are the same. Therefore, the arguments as to claims 19 and 40 are not persuasive.

Applicant also argues that claim 31, which now includes the limitations of canceled claim 32, is not anticipated by Anand; this is conceded. However, claim 31, as was claim 32 previously, is now considered obvious over Anand in view of Venkatraman et al. Applicant argues that Anand and Venkatraman et al. are insufficient to make obvious the limitations of claim 31 (as well as claims 20 and 23). However, applicant has merely argued that Venkatraman et al. cannot make up for the alleged deficiencies of Anand regarding the structural limitations of independent claims 19 and 31. That is, applicant merely argues that Venkatraman et al. does not teach "a via situated

Art Unit: 2815

within said second insulating layer and . . . lined with an organo-metallic-atomic deposited titanium-silicon-nitride layer and filled with a copper material.” Because, as was shown in the preceding paragraph, Anand *does* teach the via/insulation/metal structure of instant claims 19 and 31, the arguments are again not persuasive.

Finally, applicant argues the rejection of claims 26, 27, 35 and 36 over Anand in view of Venkatraman et al. and Reid et al. Applicant merely argues that none of Anand, Venkatraman et al. or Reid et al. teach the limitations of the amended claims. However, as shown in the above rejections, that is not true. As such, these arguments are not persuasive.


Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to George C. Eckert II whose telephone number is (703) 305-2752.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Mr. Eddie Lee can be reached on (703) 308-1690. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

GCE
December 30, 2002


GEORGE ECKERT
PRIMARY EXAMINER